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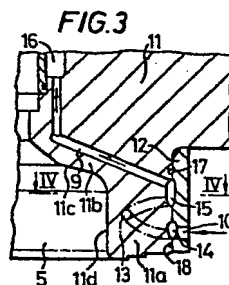
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⑤4 Cylinder cover for water-cooled internal combustion engine.

(57) In a cylinder cover incorporating a cooling arrangement, for the purpose of making it possible to sufficiently cool an inner peripheral portion (11d) of a long cylindrical leg (11a) formed in the lower part of the cylinder cover (11), said leg is provided with an upper cooling and lower annular cooling chambers 14, 15 in its outer peripheral portion, and a plurality of cooling holes (13, 13a, 13b) are formed in the inner portion of said leg and have their opposite ends opening out into respective cooling chambers 14 and 15.



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Cylinder Cover for Water-Cooled Internal Combustion Engine.

The present invention relates to cylinder-head covers for use in a water-cooled internal combustion engine, and particularly to the cooling system incorporated in such covers.

A diagrammatic view of one type of cylinder cover of the prior art is illustrated in Figure 1, and a cross-section of a long cylindrical leg of the same cylindrical cover is shown in Figure 2. In Figure 1, the cylinder cover is shown supporting an exhaust valve 2 over a cylinder, said cover being bolted down onto a cylinder liner 3 located within a cylinder jacket 4. The cylinder liner 3 and cover 1 define a combustion chamber 5 above the associated piston 6. Referring also to Figure 2, a large number of cooling holes 9 are formed in the cylinder cover 1 at a constant spacing around its circumference. Thus, in this arrangement, cooling water which has cooled the cylinder liner 3 enters into an annular cooling chamber 8 defined in the periphery of a long leg 1a of said cover and a surrounding sleeve 7 through an inlet path 10 in said sleeve 7. After cooling said long leg 1a, which is formed in the lower part of said cover, the water flows through the cooling holes 9 to cool the upper part 1b of the combustion chamber wall defined by said cover, and then flows out externally.

However, the aforementioned cooling system in the prior art had the following shortcoming.

Though the long leg 1a is cooled only by the cooling water in the cooling chamber 8, since only the outer peripheral portion of said long leg is cooled, the inner peripheral portion, that is, the portion along the part defining the combustion chamber wall 1c cannot be cooled sufficiently.

It is therefore an object of the present invention to provide a cylinder cover in which the aforementioned short-coming in the prior art is eliminated and a cooling effect for a long cylindrical leg of the cylinder cover can be enhanced.

According to the present invention, there is provided a water-cooled cylinder cover comprising an annular upper cooling chamber and an annular lower cooling chamber provided in the outer peripheral portion of a long cylindrical leg formed in the lower part of the cylinder cover, and a plurality of cooling holes formed in the inner portion of the long cylindrical leg and having their opposite ends opening out into respective annular cooling chambers.

The above-mentioned and other features and objects of the present invention will become more apparent by reference to the following description of a preferred embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a diagrammatic cross-sectional view showing a cylinder cover in a water-cooled diesel engine of the prior art,

Figure 2 is a partial cross-sectional view showing a long cylindrical leg of the cylinder cover shown in Figure 1,

Figure 3 is a view similar to Figure 2, but of opposite hand, of one preferred embodiment of the present invention,

Figure 4 is a transverse complete, cross-sectional view developed along line IV-IV in Figure 3, as viewed in the direction of the arrows, and,

Figure 5 is a longitudinal cross-sectional view taken along line V-V in Figure 4, as viewed in the direction of the arrows.

Referring now to Figures 3 to 5 of the drawings, the cylinder cover 11 constructed in accordance with the invention has a lower portion in the form of a long cylindrical leg 11a, the inner surfaces of the upper portion of the cover 11 and said leg (11c and 11d respectively) defining the upper part of a combustion chamber 5. A metal sleeve 12 is fixedly secured to the outer periphery of the long cylindrical leg 11a. Two lower and upper annular cooling chambers, 15 and 16 respectively are defined between the outer periphery of the long cylindrical leg 11a and the inner periphery of the metal sleeve 12, and circumferentially spaced cooling holes 9 are provided which communicate the upper cooling chamber 15 with an exhaust valve cooling chamber 16, these cooling holes 9 being drilled in the cylinder cover 11 close to and parallel with the upper wall surface 11c of the combustion chambers 5.

In this embodiment further cooling holes 13 are drilled in the long cylindrical leg 11a from the lower cooling

chamber 14 towards the upper cooling chamber 15 in an obliquely upward direction (see Figure 5) at an angle θ with respect to the vertical direction, these cooling holes 13 thus communicating the respective chambers 14 and 15 with each other. A plurality of such cooling holes 13 are provided so as to encircle the combustion chamber as a whole. As shown in Figures 4 and 5 the cooling holes 13 are formed in straight sections without intersecting each other, that is, without connecting to each other along their length (see numerals 13, 13a and 13b) and they are arrayed at a constant circumferential spacing. The aforementioned respective cooling holes 13 are provided as close (at a distance ℓ - see Figure 4) to the inner peripheral surface 11d of the long cylindrical leg 11a as is permissible to ensure adequate mechanical strength to withstand gas pressure at this point. "O"-rings 17 and 18 are provided between the periphery of the leg 11a and the sleeve 12 for sealing of the annular water chambers 14 and 15.

In operation of the preferred embodiment, upon operation of the engine, cooling water entering, via the inlet 10 through the sleeve 12, into the lower cooling chamber 14 flows into the respective cooling holes 13 as it flows around through the lower cooling chamber 14, and while it is cooling the long cylindrical leg 11a, it flows into the upper cooling chamber 15.

The cooling water in the upper cooling chamber 15 enters into the cooling holes 9, and after it has cooled the combustion chamber upper wall portion 11b of the cylinder cover 11, it is fed into the exhaust valve cooling chamber 16.

Due to the above-mentioned arrangement, the long cylindrical leg 11a as well as the combustion chamber upper wall portion 11b of the cylinder cover 11 can be sufficiently cooled.

Accordingly, the complete cylinder can be cooled uniformly; hence, unevenness of temperature distribution can be corrected, and thereby thermal stresses in the cylinder cover can be reduced.

In summary, the present invention provides the following advantages:

(1) Since cooling holes are provided in the inner portion of a long cylindrical leg of a cylinder cover, the cooling holes can be disposed close to a wall surface of a combustion chamber. As a result, cooling of the long cylindrical leg can be achieved sufficiently.

(2) Since the cooling holes do not intersect with each other in the long cylindrical leg, concentration of stresses can be mitigated as compared with the prior art cylinder cover described, and hence thermal stresses as well as mechanical stresses in a cylinder cover can be reduced.

Since many changes and modifications could be made to the above construction, and other different embodiments proposed, within the scope of the present invention, it is intended that all matter contained in the above description and/or shown in the accompanying drawings shall be interpreted as illustrative, and not as limiting the scope of the invention.

CLAIMS

1. A cylinder cover incorporating a cooling arrangement comprising an annular cooling chamber in the outer peripheral portion of a long cylindrical leg portion formed in the lower part of said cylinder cover, and a plurality of circumferentially spaced holes communicating between said chamber and an exhaust valve cooling chamber, characterised in that two upper and lower annular chambers (14, 15) are provided in said outer peripheral portion of said cylindrical leg portion (11a), in that said cooling ducts (9) are connected only to said upper chamber (15), and in that further cooling ducts (13, 13a, 13b) are formed in the inner portion of said long cylindrical leg and have their opposite ends opening into respective annular cooling chambers (14, 15).

2. A cylinder cover as claimed in Claim 1, characterized in that said ducts (13, 13a, 13b) are inclined upwardly at an angle θ to the vertical and are arranged so as to encircle the combustion chamber (5) in straight sections which do not interconnect.

FIG.1

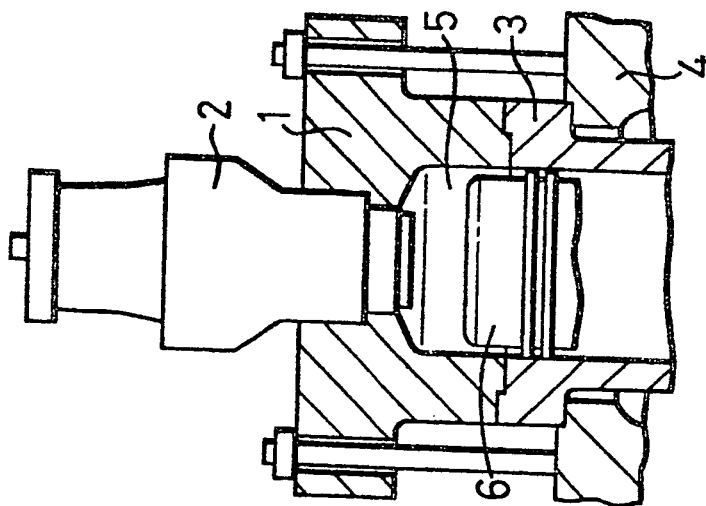


FIG.2

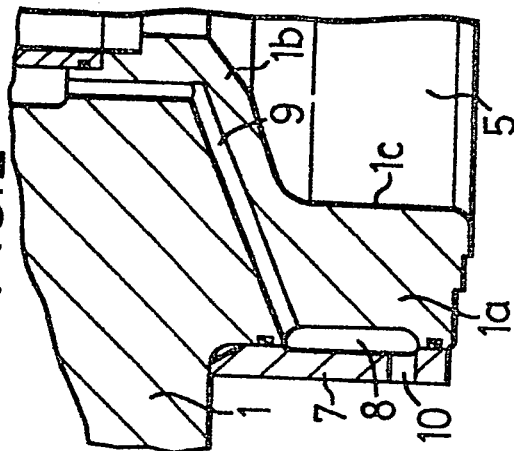
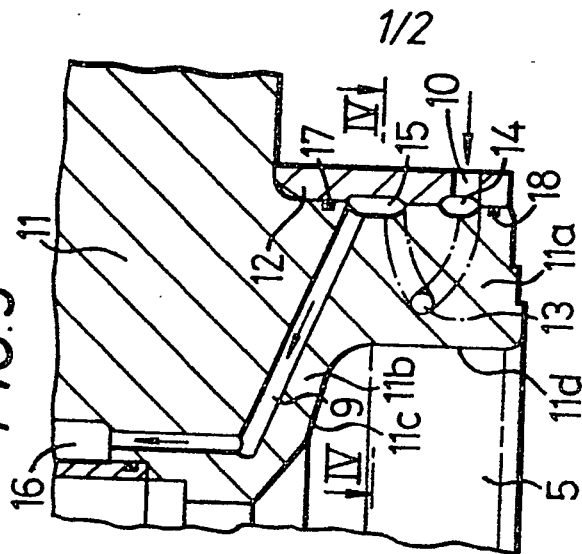
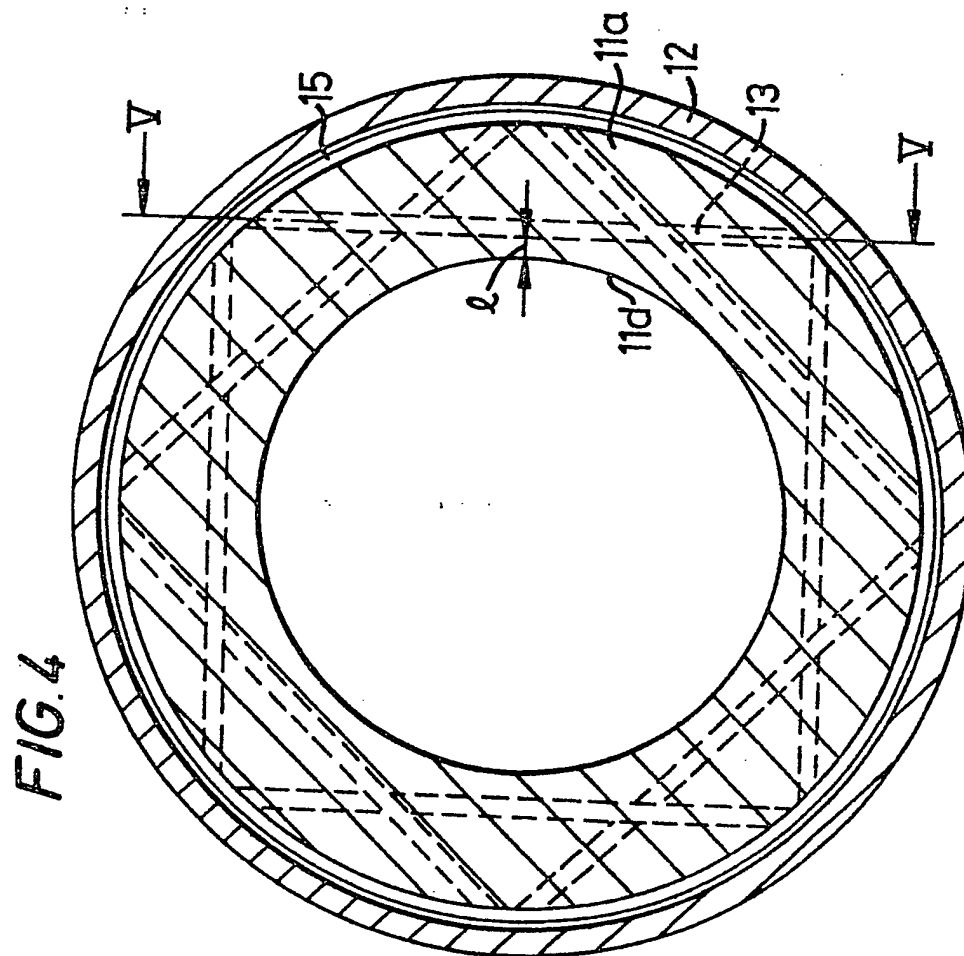
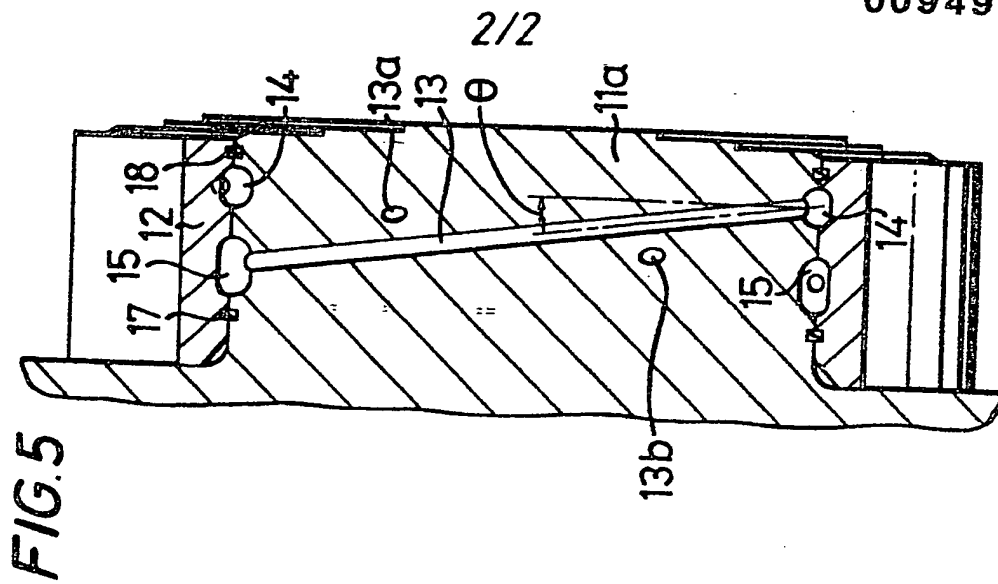


FIG.3







European Patent
Office

EUROPEAN SEARCH REPORT

0094982

Application number

EP 82 10 4585

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
A	DE-A- 959 866 (FREITAG) * Figure 1; page 2, lines 85-104; page 2, line 114 - page 3, line 4 *	1	F 02 F 1/40 F 01 P 3/02
A	FR-A-2 164 304 (SULZER) * Figures 1,2; page 4, lines 6-23 *	1,2	
A	FR-A-2 165 429 (SULZER) * Figures 1-5; page 2, line 39 - page 4, line 15 *	1,2	
A	FR-A- 910 675 (SULZER) -----		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
			F 01 P F 02 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 25.08.1982	Examiner VON ARX H.P.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	